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that the governor's palace contained an archive chamber. For aught we know, the clay tablets with which the archive chamber was once stored may still lie buried under the *débris* which has concealed the ruins of the Amorite city for so many generations from the eyes and ravages of man.

However this may be, Mr. Petrie's excavations, brief and imperfect as they have necessarily been, have taught us two important facts. The first of these facts is the mutability of local nomenclature in the East. The recurrence of an ancient name in the mouths of the modern inhabitants of Palestine by no means implies that the place to which it is given is the representative of an ancient locality of the same name. The utmost it can prove is that the ancient site is probably to be sought in the near neighborhood of the spot to which the name is now applied. The existence of a name like Khurbet 'Ajlân, given though it may be to a comparatively recent site, may yet show that the Eglon of the past once stood somewhere in its vicinity. But it can do no more. The tides of war which have swept from time to time over the civilized East have displaced the older population, have reduced the earlier cities of the land to "ruinous heaps," and have transferred their inhabitants to other places. When the Jews returned from the Babylonian exile, they were in most cases likely to settle in the open country, at a distance from the barren mounds which were all that remained of the older cities. The new Eglon would arise, not on the site of the more ancient one, but where the settlers would be surrounded by green pastures or cultivated fields. The fact is a warning to those who would place the ancient Megiddo at Mujedda on the evidence only of a similarity of name, or who would transform the "Stone" of Zohemoth into the Cliff of Zehwele, in defiance of philology and geography.

The second fact brought to light by Mr. Petrie is, that, if we are ever to learn any thing about pre-exilic Israel on the soil of Palestine itself, it must be by the help of the spade. His excavations have shown that up to now we have known nothing, or next to nothing, of the archæology of the Holy Land before the classical age. They have further shown what a rich harvest, on the other hand, awaits the excavator. Already the basis has been laid for a scientific study of Palestinian antiquities; the sites that cover the ground can now be assigned to their respective ages by means of the pottery they contain; and we can tell from a simple inspection of the stones of a building whether or not it belongs to the pre-exilic epoch. The future excavator will no longer set to work in the dark, trusting for success to chance and luck: he will know beforehand where and how to dig, and with what rewards he is likely to meet. The explorer who will devote himself to the labor, as Sir A. H. Layard devoted himself to Nineveh and Dr. Schliemann to Troy, will obtain results as marvellous and far-reaching as those obtained by Layard and Schliemann. The former story of Palestine has not been obliterated from its soil, as has often been imagined: on the contrary, it is indelibly impressed on the stone and clay which that soil still holds in its bosom. We have dug up Homer and Herodotus: we shall yet dig up the Bible.

Mr. Petrie's excavations could not be continued long enough to allow him to penetrate to that central core of the *tel* where alone he could expect to meet with inscribed stones. Apart from stone-masons' marks, in the shape of early forms of Phœnician letters, the only inscription he has disinterred is scratched on the fragment of a terra cotta vase. The inscription he assigns to the age of Hezekiah. One of the letters composing it, however, has a very archaic form, and it may therefore belong to an earlier period. But, like the famous Siloam inscription, it indicates in a curious way what was the ordinary writing-material employed by the Jews. The "tails" of certain letters are curved, the curve being represented on the refractory terra cotta by two scratches, which together form an angle. It is clear from this that the Hebrews must have ordinarily written on papyrus or parchment, where the longer lines of the characters would naturally run into curves, and not, like the Moabites, for instance, on clay, stone, or metal. They were a literary rather than a monumental people.

A seal found in Jerusalem, and belonging to Mr. Clark, has at last given us a clew to the relative age of the few Jewish inscriptions of the pre exilic period which are at present known to us.

The inscription upon it states that it was the property of "Elishama", the son of the King." Now, we hear about this Elishama' from the prophet Jeremiah (xli. 1), who tells us that he was of "the seed royal," and the grandfather of Ishmael, the contemporary of Zedekiah. Elishama', accordingly, will have flourished about B.C. 650, and we can therefore now determine what were the forms taken by the letters of the Jewish alphabet at that particular time. Comparing them with the forms of the letters in the Siloam inscription, we find that the latter must be somewhat, though not greatly, older, and that consequently the general opinion is justified which considers that the construction of the tunnel commemorated by the inscription was a work of Ahaz or Hezekiah. A fixed point of departure has thus been obtained in Hebrew epigraphy.

The excavator, then, who continues Mr. Petrie's work next season will be equipped with knowledge and resources which, only six months ago, were not even dreamed of. Discoveries of the highest interest await him,—monuments of David and Solomon and their successors; it may be even the clay records of the Amorite priests and chieftains whom the children of Israel dispossessed. The bearing such discoveries may have upon the interpretation and criticism of the Old Testament Scriptures, the light they may throw upon the conquest of Canaan or the establishment of the Davidic monarchy, cannot even be conceived; but we may feel sure that such discoveries will be achieved, if only the means of achieving them are provided: and provided we cannot doubt they will be, as soon as the results of Mr. Petrie's preliminary campaign are made known to scholars and lovers of the Bible. In wealthy England the Palestine Exploration Fund cannot fail to find that money for the work will flow to it in abundance.

SUGAR AND THE SUGAR-CANE IN CUBA.

M. TRUY, French consul at Santiago de Cuba, says, according to the *Journal of the Society of Arts*, London, that the cultivation of the sugar-cane in the eastern portion of the Island of Cuba is almost entirely confined to the districts of Santiago, Guantanamo, and Manzanillo. This cultivation, although it has experienced some extension of late years, is not in the flourishing condition it was twenty years ago. This falling-off is due to the civil war, which ruined many planters and discouraged others. The profits, however, realized for some time past by those planters who had sufficient credit, or confidence in the future, to continue to engage in this industry, have given a stimulus to the cultivation of the cane. Sugar-factories have been established in many parts, particularly in the district of Guantanamo and Manzanillo; old sugar-factories have been supplied with fresh plant; and many planters, encouraged by the high prices recently realized, have hastened to get their ground ready for cultivation. Part of the products of the province of Santiago is shipped to Spain, and some small quantity is consigned each year to Canada; but the United States absorbs almost the whole of the yield of the island. The Cuba market was some years ago controlled by French merchants, who owned the greater part of the sugar-factories of the province; but since the civil war many planters sold their estates, and retired to France. A few estates, however, are still owned by Frenchmen, at Guantanamo especially. Those known as Sainte Marie, Sainte Cecile, and San Antonio are directed or owned by Frenchmen. All the land in the island is, in general, fit for the cultivation of the cane, an even surface being generally chosen with a view to facilitate the working and the harvesting. The ground should also be as near the sea as possible, so as to avoid the cost of carriage and transport, which is particularly high in that part of the island, where it may be said there is an absence of railroads, and the carriage roads are in a deplorable condition. If the ground chosen is one that has hitherto been uncultivated, the planter, first of all, clears it in cutting down the branches of the trees and small shrubs with the *machete*, and burning the larger trees. The expenses of these preliminary operations may be estimated at from four hundred to five hundred dollars per plantation of thirteen hectares (the hectare is equivalent to 2.47 acres). Holes are then dug at intervals of from three to four feet, and in them are placed hori-

zontally pieces of cane of a length from two to three joints. If the ground has previously been under cultivation, the methods differ. The ground must first of all be ploughed, and furrows are then made in which entire canes are stretched *à chorros*; that is to say, end to end horizontally. The plants are then covered with earth. The sugar-cane is frequently planted in the spring, but many planters are of opinion that plantations in Cuba sown in winter give a much better yield. The young plants are allowed to shoot for ten or eleven months if they have been planted in the spring, for fourteen or sixteen months if planted in the winter, and the harvest then takes place. There are in the island several varieties of sugar-cane,—the white or Otaheite cane, the twisted white cane, the twisted violet cane, and the so-called black cane. The first two varieties are the only ones cultivated at Cuba. The white cane is prepared for planting in virgin soil, and gives a good yield. The crystalline is reserved for old plantations: it is better adapted to resist the long drought than the white variety. The cultivation of the last three species of sugar-canes has been abandoned on account of their insufficient yield. Before the abolition of slavery, the planters themselves cultivated their fields; since that period, however, they have experienced the greatest difficulty in obtaining a sufficient number of hands to harvest their canes. Many planters, in consequence, deemed it advisable to divide their labor between a certain number of colonists, who are bound to cultivate each his plot of ground, to plant the canes, to cut them at harvest time, and to carry them to the factory, where they receive, after the sugar is turned out, a certain proportion of the quantity of the sugar extracted from the canes harvested on their allotments. Cuban sugar is generally prepared for export. The special quality intended for home consumption is clearer and finer than that shipped abroad.

THE UNIT MEASURE OF TIME.¹

I DESIRE at the opening meeting of this section of the Royal Society to bring to your attention a subject of some general importance.

For a number of years past attempts have been made on both sides of the Atlantic to effect a reform in the method of reckoning time. The degree of success which has attended the movement is a matter of surprise when we consider that the changes involve a departure from the usages of society, and are in opposition to the customs of many centuries.

The modern introduction of rapid means of communication has created conditions of life different from those of preceding generations. It may be said that until a few years back, localities separated by a few miles of longitude were assumed to have distinct and separate notations of time. When many localities were first brought into close relations by the establishment of a line of railway, the different local times (so called) with which the railway authorities had to deal produced much confusion. In order to attain security for life and property in operating the line, and likewise to promote the convenience of the public using it, it became necessary to observe a uniform notation, which received the name of "railway time;" that is to say, the many local reckonings which prevailed at the numerous points between the two termini were reduced to a single reckoning common to the many localities.

As lines of railway multiplied, the unification of the reckoning of time became more indispensable, and it early came to be seen that the benefits to result from unification would be in proportion to the extent of territory embraced within its operations. At length it became obvious that uniformity of reckoning might with advantage be extended to a whole continent or the whole globe. Investigation also established that such an extension would contravene no law of nature, or principle of science.

The proposal to supersede the numberless local times by a single notation, synchronous in every longitude, had a somewhat Utopian aspect. Many, indeed, regarded it as a revolutionary innovation, for it came into direct conflict with the customs and the

habits of thought which had descended from a remote antiquity. Nevertheless, the potent agencies steam and electricity, which have co-operated in making astonishing transmutations in human affairs, have forced on our attention the investigation of time and its notation, and demanded some change to meet the altered circumstances of daily life.

If we consider the nature and attributes of that which we know as time, we will find that it is wholly independent of material bodies, and uninfluenced by space or distance; that it is essentially non-local and an absolute unity; that it is not possible for two times to co-exist, or for time to be divided into two parts having a separate entity, in the sense that material things can be divided. This view of time incontrovertibly established, there is no ground for the theory that there are many local times. We may therefore sweep away the ordinary usages based on that theory as being unsound and untenable, and the way is made clear for a comprehensive system of time-reckoning to embrace the whole globe.

About fourteen years ago the effort was first made to introduce a reform which would satisfy the requirements of the age. Whatever system might be adopted, it was felt that it should be based on the fundamental principle that there is only one time. It was, moreover, held to be expedient that there should be only one reckoning of time common to all nations; and, to secure a common reckoning, one established zero and one common unit of measurement became necessary.

With the attainment of these objects in view, preliminary discussions took place at the meetings of several scientific associations in Europe and America, and it was held that in a matter of such widespread importance the unit of time should be a measure which could be readily referred to as a perpetual standard for the use of the entire human family. It was likewise felt desirable, if not indispensable, that all nations should acquiesce in its recognition.

It was accordingly proposed at an international geographical congress at Venice in 1881, and confirmed at a geodetic congress at Rome held two years later, that the government of the United States should be invited formally to call a conference of representatives, to be specially appointed by the governments of all civilized nations, to consider the subject, and determine the zero and standard of reckoning to be used in common throughout the globe.

Six years ago this conference assembled, under the auspices of the United States, in the city of Washington, the governments of twenty-six nations sending fully accredited delegates. Their deliberations extended over the month of October, 1884. With substantial unanimity they passed a series of resolutions, in which the unit of measurement was constituted, and they recommended that time be computed according to the solar passage on a recognized zero meridian of the earth's surface.

The resolutions of the Washington conference thus authoritatively established the fundamental principles which underlie the scheme for a general unity of time-reckoning; each nation being left in its discretion to accept the details of the reform whenever deemed expedient in each individual case. To facilitate the acceptance of the new system, the circumference of the globe has been divided into twenty-four sections, the reckoning in each section being based on a standard subsidiary to, but directly related to, the unit measure. In the twenty-four subsidiary standards thus constituted the hours are simultaneous, although differently numbered in accordance with the longitude of the several sections. With the single exception respecting the numbers by which the hours are locally to be known, there is complete identity in every subdivision of time throughout the twenty-four sections. The many local days which follow in succession during each diurnal period are by this arrangement reduced to twenty-four normal days, each differing an hour in its commencement from the day which it succeeds. Twelve of these normal days precede, and twelve follow, the primary standard or unit measure of time, which is the mean of the whole series of normal days. By this expedient, which has received the name of "the standard time system," the means have been provided by which all nations, without any apparent great departure from old usages, may observe substantially the one common reckoning.

¹ Address at the opening of Section III. of the Royal Society of Canada, by the president, Dr. Sandford Fleming, May 27, 1890.